Medical Student Service Learning Improves Community Health Literacy

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ABSTRACT

Objective: To assess the impact of a medical student service learning initiative on community knowledge of hypertension.

Background: Medical education has recently placed a greater emphasis on service learning. Studies have shown that service learning positively impacts students' education and perception of the value of community engagement. While these studies have demonstrated positive student outcomes, there is a paucity of literature focusing on the health outcomes of the communities that these programs aim to influence. Reciprocal knowledge transfer is critical to achieve accountability to the communities where the service learning is taking place.

Methods: A seven-person medical student team designed and implemented a project to assess community knowledge of hypertension at a neighborhood health clinic. Baseline knowledge of hypertension was assessed via a pre-test to 42 voluntary participants. Two post-tests separated by one month were used to evaluate short- and long-term retention after an informational pamphlet on hypertension was provided.

Results: A statistically significant difference (p-value < 0.05) was observed between mean total scores of pre-test and both post-tests. Statistically significant differences in mean question scores between pre-test and both post-tests were also discovered. Finally, percent changes of total scores from pre-test to post-test 1 were positive for all but three participants. From post-test 1 to post-test 2, percent changes were positive in all but two participants.

Conclusions: In this study, knowledge of hypertension was used as a surrogate for health literacy. The results from this project show increased long-term knowledge of hypertension risk factors, complications, and management strategies. These results demonstrate that reciprocal transfer of knowledge is possible in a medical student service learning context. These results help to further the support service learning by demonstrating tangible community benefits in addition to the already known positive impact on medical student learning.

INTRODUCTION

As our health system changes, the integration of service learning into medical school curricula is key for cultural competency and patient advocacy training of future physicians.[1,2] The Association of American Medical Colleges (AAMC) notes the importance of service learning, specifically how it allows students to step out of the classroom and into the real world to experience health concerns affecting their respective communities. Often, oral or written reflection of service learning experiences is documented in an educational portfolio.[3] However, according to reports from the AAMC 2014-2015 Curricular Inventory (CI), only 29 out of 135 medical schools that participated in the CI are teaching service learning.[3,4]

This deficiency is beginning to be addressed by some institutions. For example, medical students at New York University (NYU) School of Medicine felt that their curriculum needed service learning. Thus, in 2015 they established their Community Service Program to recognize students for their commitment to community health needs. They proposed that students complete 100 service hours and two reflective essays by the end of their third year of medical school. The students were successful at implementing this innovative program and have since recognized countless of students for their dedication to this mission.[4] Furthermore, the University of Rochester Medical Center introduced the Community Health Improvement Clerkship (CHIC) to their fourth-year curriculum in order to target community health issues.[5] In this clerkship, students received classroom and online education on public health after which they designed sustainable community projects by applying what they had learned. Similarly, the University of North Carolina at Chapel Hill School of Medicine developed the Advanced Leadership Skills in Community Service (ALSCS) elective to provide students with a robust service learning

experience.[6] Several other medical schools have started to employ a combination of didactic sessions, student-led community health projects, creation of community service offices, and measurement of student outcomes (especially in the domains of attitudes, knowledge, and leadership skills) after completion of these experiences to address the need for service learning in the medical curriculum.[7-12]

Although the articles cited above illustrate students successfully integrating service learning into their medical school curricula, none referenced the positive effects or improved health outcomes for the communities in which their service learning took place. In a systematic review of literature on service learning in U.S. medical schools, Hunt et al.[13] describe the majority of literature emphasizing the student benefits while only a limited amount indicates a positive impact on the community. Additionally, they note that in order to better prepare the medical student to practice in an evolving healthcare system, reciprocity in learning and increased community involvement must be considered when integrating community service projects into medical education.

At The Ohio State University College of Medicine (OSUCOM), service is an integral component of the Lead.Serve.Inspire (LSI) curriculum and is best represented through the student-led Community Health Education (CHE) project. This is a yearlong experience in which first-year students develop a partnership with a community leader and together assess the needs of an underserved population in a clinic or agency of the Greater Central Ohio community. Based on those needs, students design a project and gather appropriate materials. The proposals are finalized and ultimately implemented any time over a 7-month span. Around 30 diverse

projects are completed each year. In the second year of the curriculum, students are evaluated through a poster presentation. Groups are subsequently invited to present their posters at a community health conference. Students are also encouraged to write a reflective essay regarding their experiences with CHE. Many OSUCOM students find CHE to be an invaluable service learning experience.

To our knowledge, we are unaware of a medical student-led community service project that has focused on making a measurable difference in health outcomes for the community of interest. We describe this project as validation that integration of service learning into the medical school curriculum can have a significant impact in improving community health outcomes. In this case, the outcome parameter was health literacy as appraised by short- and long-term retention of knowledge pertaining to hypertension.

This CHE project focused on the health literacy of its targeted population because its ability to directly measure the transfer of knowledge to the community members. Additionally, the World Health Organization (WHO) has emphasized the association between low health literacy and an individual's engagement with medication adherence, increased hospitalization rates, increased morbidity, and death prematurity[14] This study was designed to assess and improve the knowledge and understanding of hypertension in a largely Hispanic, low-income patient population.

MATERIALS & METHODS

All methods for this study were approved by the Institutional Review Board (IRB) at The Ohio State University.

42 unique individuals with scheduled appointments at a neighborhood clinic volunteered to participate in the project. Each participant's age and primary language preference (Spanish or English) were collected to gauge the population we were reaching. Data were also collected approximately one month later by telephone and promptly analyzed. We recorded the percent changes in scores for participants between pre-test and each post-test. Finally, we measured the mean scores, standard deviations, and standard errors for each question.

Data collection was performed by all team members during implementation. We used publicly available software from Google LLC to construct the questionnaire.[15] Copies of the questionnaire were printed so as not to exclude any participant without typing skills. During each site visit, team members administered the pre-test to voluntary participants. The intervention (informational pamphlet, refer to subsection *Informational Pamphlet*) was then handed to the participant to read. Five to fifteen minutes later, the same five-item questionnaire (post-test 1) was administered. Approximately one month later, the questionnaire was administered a third time (post-test 2) via telephone to 20 random participants to assess for long-term retention. Respondents were mailed gift cards for participation in the study.

Informational Pamphlet

This document (Figure 1) served as the intervention in this study. The pamphlet was created to emphasize foundational information about hypertension that we believed every hypertensive patient should know such that he/she/they are able to maintain integral activity in his/her/their own healthcare. This pamphlet is a culmination of information from the American Heart Association fact sheet on blood pressure[16] and inputs from OSUCOM faculty. The pamphlet contains information regarding the definition of hypertension, its complications and risk factors, as well as lifestyle management techniques. It was translated into Spanish by fluent-speaking members of our team to engage more patients.

Questionnaire Development

The pre- and post-test assessments (Fig 2a, 2b) were designed to collect a breadth of information about current knowledge of hypertension in our patient population. The questionnaire consisted of five questions, three of which required written/typed answers. The other two questions were presented as multiple-choice with four possible answers, but only one correct answer. The first question (Q1) measured the participant's ability to define hypertension (high blood pressure) and was presented as an empty text box. Q2 was a multiple-choice question asking what the warning signs of hypertension were. The answer choices were: "headache", "usually no warning signs", "sore throat", and "fever". The correct answer was "usually no warning signs". Q3 asked the participant to provide two health risks associated with hypertension. Appropriate responses included "heart attack", "heart failure", "chest pain", "stroke", "kidney damage", "vision loss", "memory impairment", and "fluid in the lungs". Q4 asked whether the participant was aware of systolic and diastolic blood pressure numbers above

which one would be considered at-risk for hypertension. This was presented as multiple-choice with the correct answer being "120/80". Finally, Q5 asked to provide three ways that hypertension could be managed. Appropriate responses included "limit alcohol use", "maintain a healthy weight", "eat a balanced diet", and "taking medications as prescribed". Appropriate responses to all questions could be traced back to information presented in the pamphlet (intervention).

Scoring Rubric Development

In this study, a scoring rubric was crafted that consisted of three categories: subjective, conditionally objective, and purely objective. The added complexity of having more than one category provided a robustness with which prior participant knowledge and later comprehension could be gauged. One question (Q1) represented the subjective category, while two questions represented each of the other two categories: conditionally objective (Q3, Q5) and purely objective (Q2, Q4).

More specifically, quantification of arguably the most important question in our survey (Q1, "What is high blood pressure?") mandated the development of our scoring rubric. The subjective nature of the question could not have been objectified via other methods e.g. converting it into a multiple-choice question because this would sacrifice the capture of bona fide answers that exposed a deeper current understanding of hypertension in our study sample. A multiple-choice question may have also introduced the confound of chance. The scoring rubric was extended to include the conditionally objective questions for the same reason. All three of these questions (Q1, Q3, Q5) required study participants to write answers, so quantifying the

variation in word choice and other aspects of written communication again supported the use of our scoring rubric. Finally, the purely objective questions were presented as multiple-choice with four possible responses each and only one correct answer.

A maximum value of seven points was assigned to a fully correct answer, while a minimum value of one point was reserved for incorrect, unrelated responses, or no response at all. Questions Q1, Q3, and Q5 were tiered appropriately (Figure 3). While 42 participants had completed the pre-test, data is available for 30 participants in the post-test 1 group and 17 participants in the post-test 2 group due to loss of follow-up.

RESULTS

Demographic Distribution

17 of the 42 respondents (40%) preferred to complete the surveys in English while the other 25 (60%) preferred them in Spanish (Figure 4).

Main Results

The alpha-level for this study was set at 0.05. P-values less than 0.05 indicate statistical significance. Means are represented with their associated standard deviations unless otherwise noted.

Total scores for each participant in each group (pre-test, post-test 1, post-test 2) were tabulated and averaged. Figure 5 illustrates the mean scores of the three periods. A single factor analysis of variance (ANOVA) was calculated among these three groups to determine the

presence of statistically different means. The ANOVA demonstrated a F-value of 27.25, which was greater than the established F-critical value of 3.10 (degrees of freedom = 2, p-value = 6.80E-10) thus prompting a student's two-tailed t-test to determine the source of the difference. There was a statistically significant difference between pre-test (14.33 ± 6.63) and post-test 1 (25.77 ± 8.51) mean scores (p-value = 1.08E-7) as well as pre-test and post-test 2 (25.94 ± 6.73) mean scores (p-value = 1.43E-6). Although the post-test 2 group mean score was higher than that of the pre-test 1 group, this difference did not achieve statistical significance (p-value = 0.94).

We conducted further analysis on each question of the survey between the three groups. We found a statistically significant difference in mean scores for every question between the pre-test and post-test 1 groups. (p-values = 4.14E-5 [Q1], 1.24E-3 [Q2], 5.75E-5 [Q3], 3.10E-3 [Q4], 2.43E-6 [Q5]). Mean values are reported in Figure 6. Statistical significance was also achieved for each question between the pre-test and post-test 2 groups except for Q4 (p-values = 1.58E-3 [Q1], 1.46E-2 [Q2], 2.85E-4 [Q3], 5.26E-2 [Q4], 3.02E-10 [Q5]). However, this anomaly would become significant if our alpha-level were set to 0.1. Interestingly, Q5 would also approach significance (p-value 5.82E-2) if the alpha-level were as mentioned, but in the *post-test 1 vs. post-test 2* comparison.

Finally, percent changes of total scores between the pre-test and post-test 1 as well as between the pre-test and post-test 2 were calculated for all participants for whom this data was available. Between the pre-test and post-test 1 groups, the range of percent changes was [-46.15% to 600.00%], revealing that a few participants (n = 3) scored lower on the immediate post-test after the pamphlet of information was presented (Figure 7). However, the majority

(n=27) increased their total score by an average of 114.12% ± 131.32. Between the post-test 1 and post-test 2 groups, the mean percent change was +90.07% ± 103.49 (range = [-13.33% to 400.00%], n = 17). This is shown in Figure 8.

DISCUSSION

Service learning is a structured learning experience that provides medical students with the privilege to positively influence their local communities [3]. The number of articles emphasizing the benefits that service learning projects have on the education of medical students is extensive. Yet, there is limited literature on the positive outcomes for the communities in which these projects are taking place. The purpose of this study was to emphasize the importance of reciprocal transfer of knowledge as an outcome of our Community Health Education (CHE) project.

In this study, knowledge of hypertension served as a surrogate for health literacy. Health literacy persistently has been shown to enhance health outcomes multidimensionally.[17-20] The results from this project revealed an increase across both short- and long-term knowledge of hypertension risk factors, complications, and management strategies. These results demonstrate that reciprocal transfer of knowledge is possible in a medical student service learning context. Given that most medical schools in the United States do not have a structured service learning program as part of their curricula[13,22] and that few reports have addressed a measurable impact on community health outcomes,[13] these results further support integration of service learning into medical school curricula by demonstrating tangible community benefits in addition to the already known positive impact on medical student learning.

While this study was effective in educating the community about hypertension, there are areas for improvement. For instance, while we reached both Spanish- and English-speaking participants, there was a considerable Somali-speaking population that we failed to reach due to

the language barrier. Future efforts could involve translating the interventional pamphlet into Somali (and other languages) and recruiting a team member who is fluent. Secondly, we primarily utilized written documents combined with verbal instruction. Future projects could consider employing different teaching modalities such as videos or interactive modules to deliver the same health information and observe for differences in participant knowledge retention based on the delivery method. This information could then be relayed to the clinic to maximize health literacy. Finally, because a large proportion of participants were lost to follow up, mostly due to incorrect call-back telephone numbers, finding alternative ways to follow up with the participants would be helpful in increasing our statistical power.

CONCLUSION:

Medical education has recently placed a greater emphasis on service learning. Studies have shown that service learning positively impacts students' education and perception of the value of community engagement. Yet, there is a paucity of literature focusing on the health outcomes of the communities that these programs aim to influence. Through this project, we illustrate that reciprocal transfer of knowledge is a valuable measure of accountability to the communities where the service learning is taking place.

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FIGURES

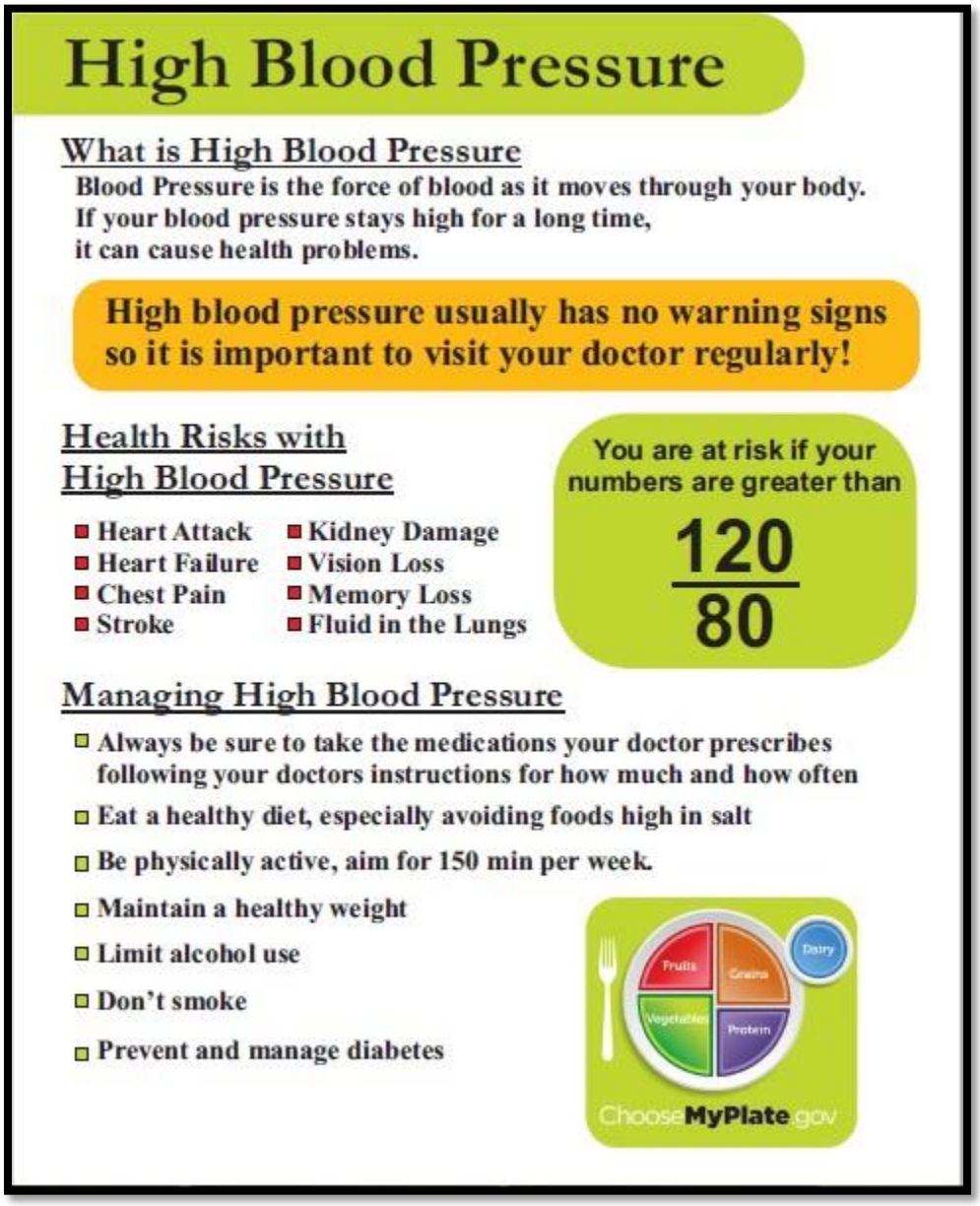


Figure 1. Informational Pamphlet. This document was created to provide information on hypertension to patients.

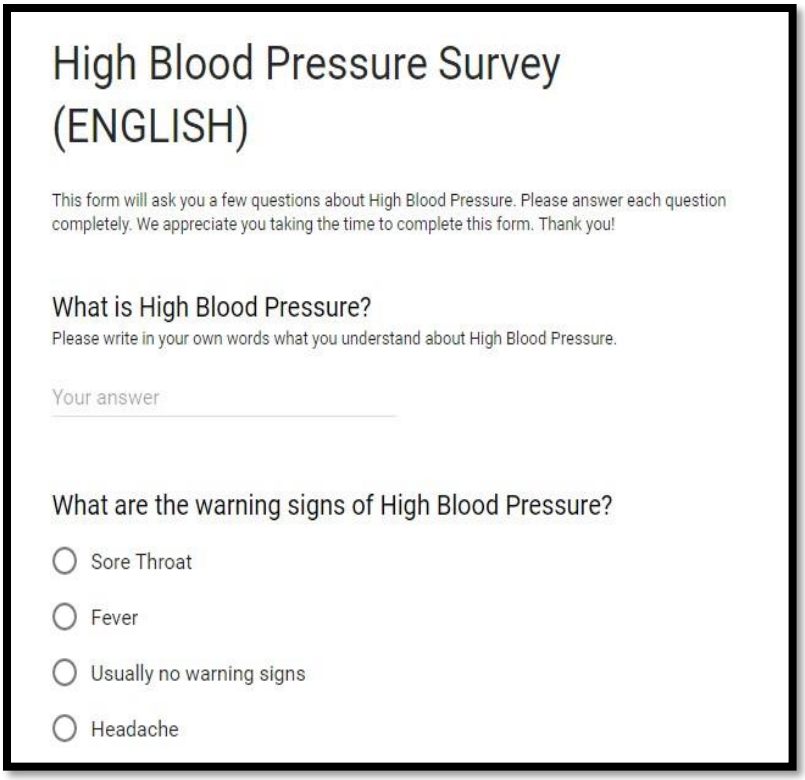


Figure 2a. Pre- & Post-test Assessments. This assessment consists of five questions that ask about hypertension. Answers for the questions were traceable back to the informational pamphlet (Fig 1).

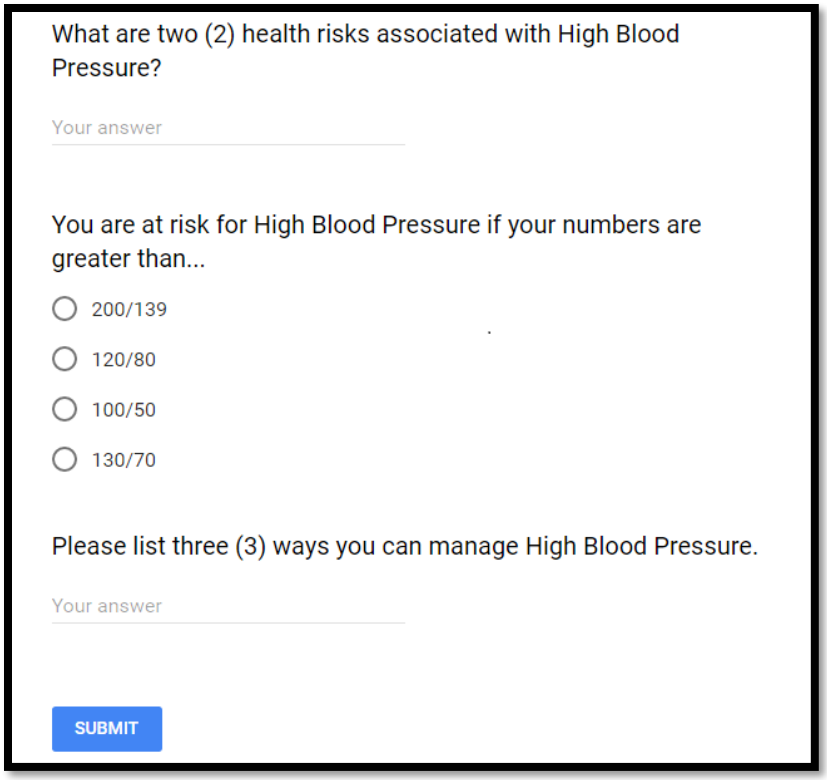


Fig 2b. Pre- & Post-test Assessments. This assessment consists of five questions that ask about hypertension. Answers for the questions were traceable back to the informational pamphlet (Fig 1).

Scoring Rubric				
Q1	Q2	Q3	Q4	Q5
1 Blank or unrelated	1 Blank or incorrect	1 Blank or incorrect	1 Blank or incorrect	1 Blank or incorrect
4 Inaccurate but related	7 Correct	4 One correct answer	7 Correct	3 1 correct answer
7 Accurate		7 2 or more correct answers		5 2 correct answers
				7 3 or more correct answers
Subjective	Pure Objective	Conditionally Objective	Pure Objective	Conditionally Objective

Figure 3. Scoring Rubric. Questions were designed to assess different aspects of the informational pamphlet. Responses were quantified for data analysis.

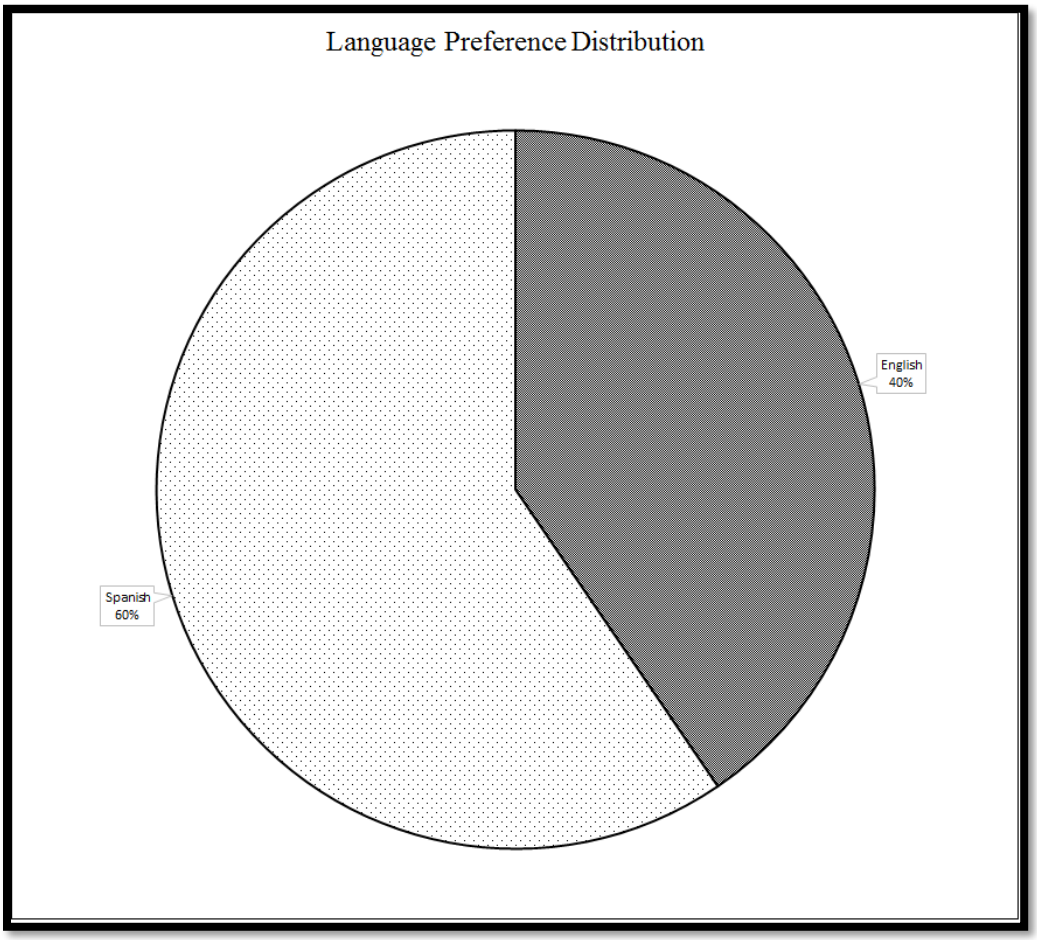


Figure 4. Language Preference. This pie chart shows our sample's distribution of participants who preferred to take the assessments in English or Spanish.

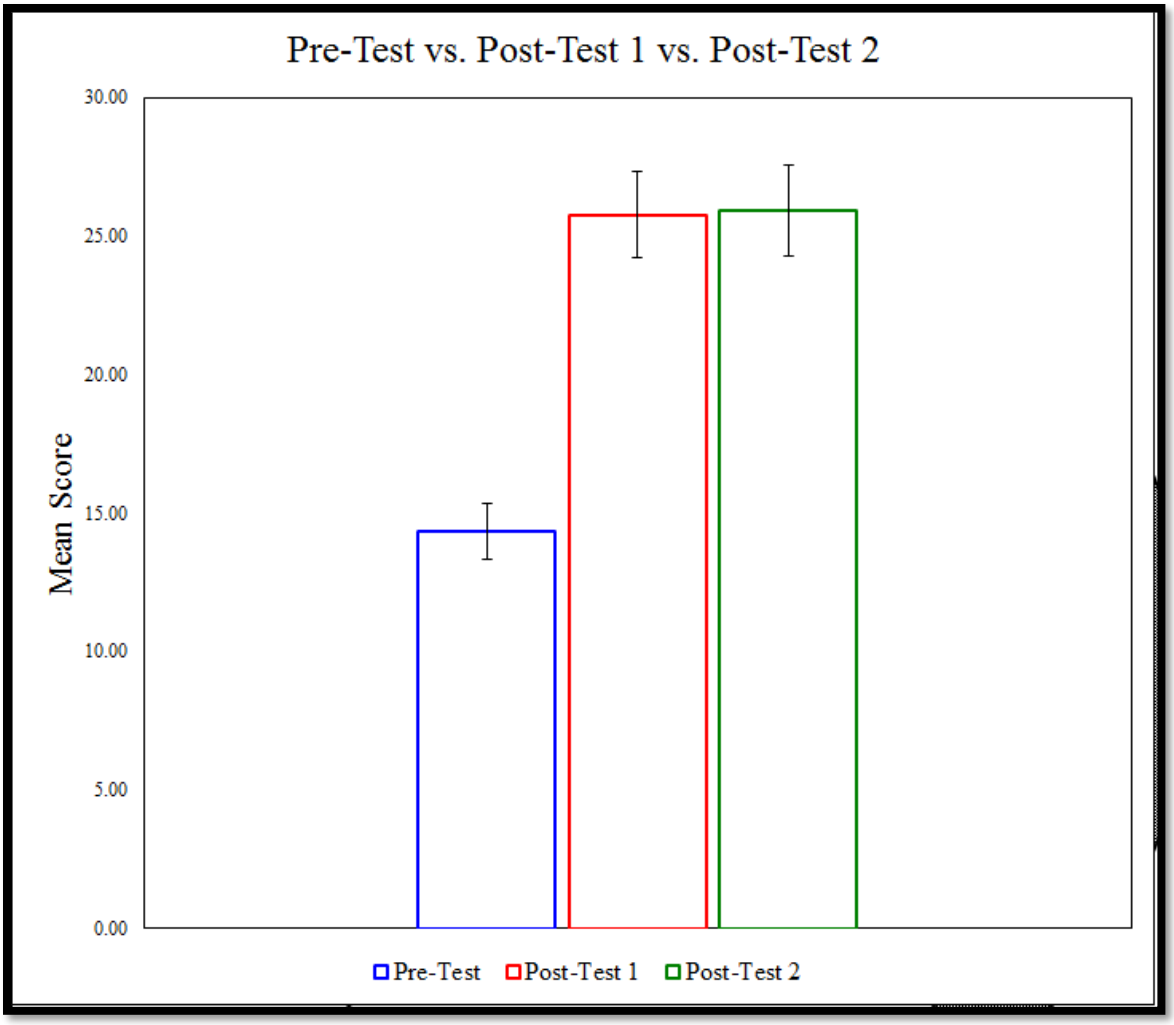
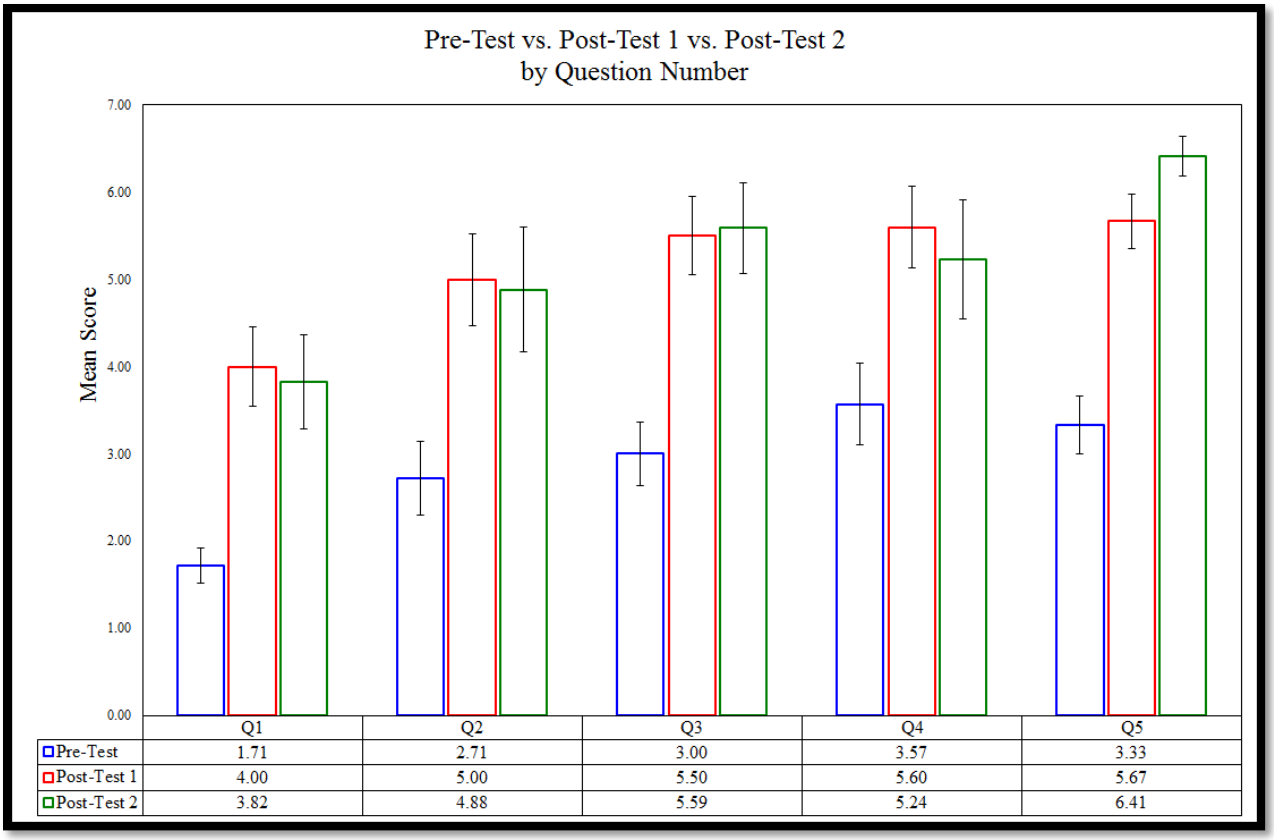


Figure 5. Mean Total Scores. This graph shows the comparison of mean total scores between pre-test, post-test 1, and post-test 2.



	Q1	Q2	Q3	Q4	Q5
Pre-Test	1.71	2.71	3.00	3.57	3.33
Post-Test 1	4.00	5.00	5.50	5.60	5.67
Post-Test 2	3.82	4.88	5.59	5.24	6.41

Figure 6. Mean Scores per Question. This graph shows the comparison of mean scores broken down by question between pre-test, post-test 1, and post-test 2.

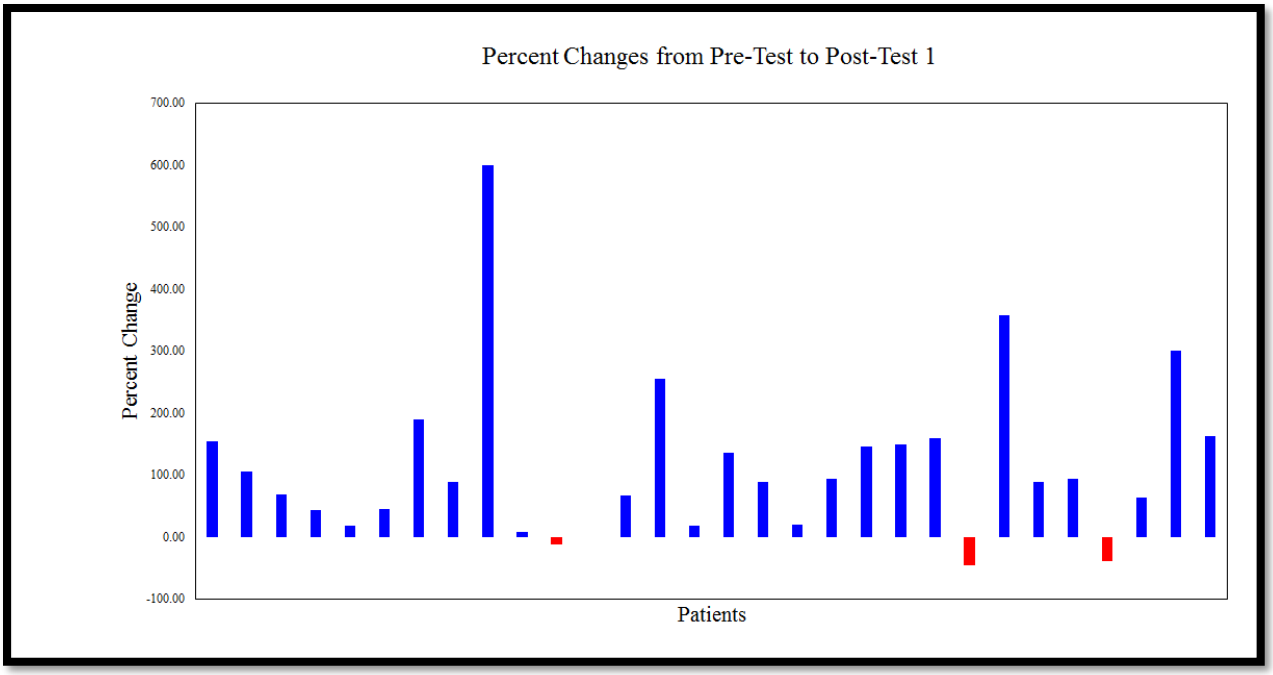


Figure 7. Percent Changes from Pre-test to Post-test 1. This graph shows the distribution of percent changes in total scores from pre-test to post-test 1.

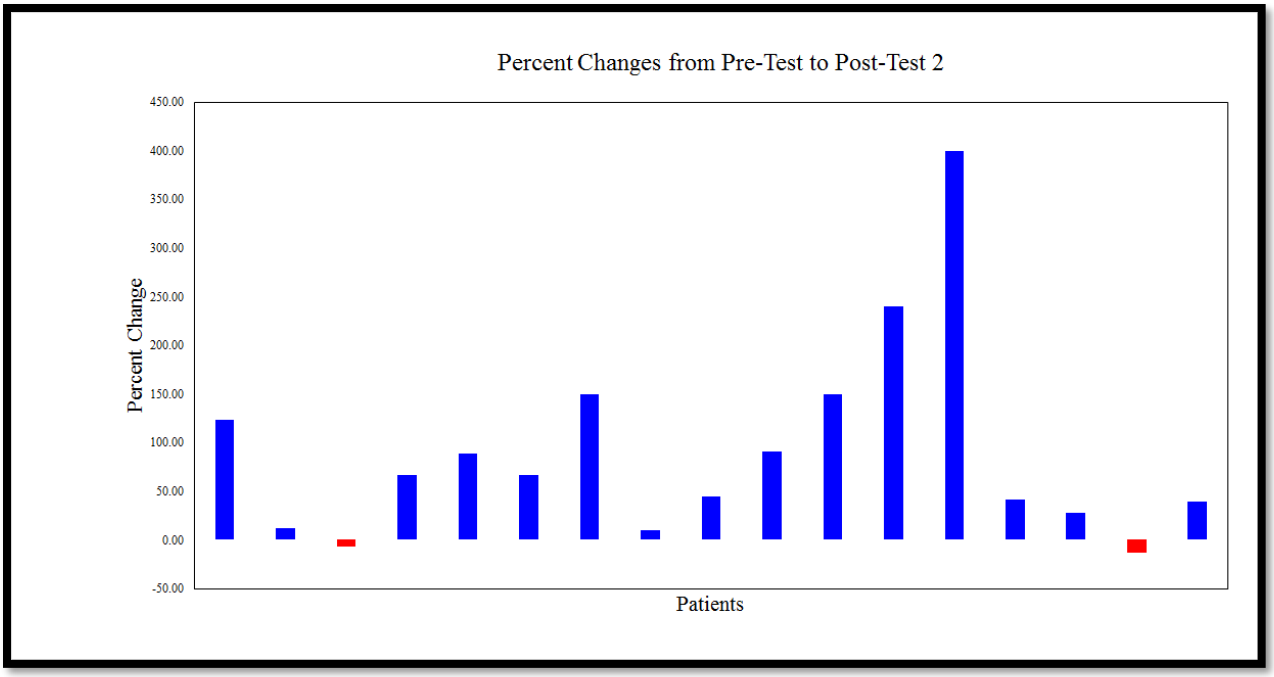


Figure 8. Percent Changes from Post-test 1to Post-test 2. This graph shows the distribution of percent changes in total scores from post-test 1 to post-test 2.